MACHINE FOR CONVOLUTING SODA STRAWS OR THE LIKE

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This invention relates to the production of soda straws or the like in which a portion of the straw is convoluted so that it may be bent very readily without collapsing the straw.

One object of the present invention is to provide a new and improved method and means of convoluting soda straws at extremely high speed, without any need for mounting the straws on a mandrel or otherwise providing internal support.

A further object is to provide a new and improved method in which a soda straw may be convoluted very quickly and readily in one set of operations carried on simultaneously on the straw.

Another object is to provide a new and improved machine whereby a succession of straws may be spun at high speed without any internal support and whereby localized pressure may be applied at successive closely spaced points along the straw to produce annular convolutions in the straw, the machine being arranged to exert endwise force on the straw so as to compress the convolutions.

A further object is to provide a convoluting machine which convolutes soda straws very efficiently and rapidly yet is easy to manufacture and low in cost.

Further objects and advantages of the present invention will appear from the following description, taken with the accompanying drawings, in which:

Fig. 1 is a plan view of a convoluting machine to be described as an illustrative embodiment of the present invention.

Fig. 2 is a fragmentary diagrammatic plan view showing stages of the progress of a straw through the machine, parts of the machine being broken away for clarity of illustration.

Fig. 3 is a fragmentary enlarged sectional view, taken generally along a line 3—3 in Fig. 1, with various parts broken away.

Fig. 4 is a view somewhat similar to a portion of Fig. 3, but on a still larger scale, the view being arranged to show the manner in which the convolutions are formed in the straw.

Fig. 5 is a cross-sectional view taken generally along a line 5—5 in Fig. 4.

Fig. 6 is a sectional view of the machine taken generally along a line 6—6 in Fig. 1.

Fig. 7 is a fragmentary sectional view, taken generally along a line 7—7 in Fig. 3.

Fig. 8 is a fragmentary sectional view taken generally along a line 8—8 in Fig. 3.

Fig. 9 is a view taken generally along a line 9—9 in Fig. 3.

Fig. 10 is an elevational sectional view showing a convoluted soda straw in actual use.

It will be apparent that the present invention relates to the manufacture of convoluted soda straws 20 (Fig. 10) in which a portion of each straw is convoluted or corrugated so that the straw may easily be bent without collapsing the straw. Thus, the illustrated straw 20 has a convoluted section 22 near the upper end of the straw. The convoluted section 22 enables the straw 20 to be bent at a sharp angle around the lip of a glass 24 or the like, without collapsing the wall of the straw.

From Figs. 4 and 5 it will be apparent that the straw 20 is tubular in form and thus comprises a thin cylindrical wall 26 made of paper or other suitable sheet material. Along the convoluted section 22, the straw 20 is formed with a series of circumferential corrugations or convolutions 28 which are formed inwardly from a cylindrical wall 26. In this case, the convolutions 28 are annular in form and are parallel to one another.

Figs. 1—9 illustrate a machine 30 for forming the convoluted straw 20 from simple tubular unconvoluted straw 31. The machine 30 convolutes the straws by spinning each of them in turn at high speed, while the wall of the straw is pushed inwardly at a series of closely spaced points so as to form the annular convolutions 28. During the formation of the convolutions, the machine compresses the straw endwise so that the convolutions will be compressed as they are formed.

The machine is adapted to spin the straws by bringing each straw into frictional engagement with one or more continuously moving drive members, which might comprise drums or pulleys, but are illustrated as endless flexible belts 32, 33 and 34. Thus, three belts are employed in this case and are arranged to engage the straw at points spaced along its length, so as to prevent the straw from being twisted or bent.

The first two belts 32 and 33 are substantially parallel to each other, while the third belt 34 extends at a small angle to the other belts. In other words, the third belt 34 is disposed along a line which converges gradually toward the lines of the belts 32 and 33. All of the belts 32, 33 and 34 extend approximately at right angles to the straw to be convoluted, but the belts are actually angled slightly rather than being strictly perpendicular to the straw. The first two belts 32 and 33 are angled in one direction, while the third belt 34 is angled in the opposite direction. This arrangement has the effect of applying endwise compressive force to the straw engaged by the belts, particularly to that portion of the straw between the second and third belts 33 and 34.

The belt 32 is supported on 2 pulleys 36 and 37, while the belt 33 is supported on pulleys 38 and 39. Similarly, the belt 34 is supported on pulleys 40 and 41. The pulleys 36 and 38 for the belts 32 and 33 are secured to a drive shaft 44, while the pulleys 37 and 39 are mounted on an idler shaft 46. A flexible drive coupling 48 is connected between the drive shaft 44 and the pulley 40 for the third belt 34, while the pulley 41 is supported on an idler shaft 50. A drive pulley 52 may be mounted on the shaft 44 and may be connected by means of a belt 54 to a suitable drive motor or the like (not shown) so that the pulleys 36, 38 and 40 will be rotated together at the same speed.

In the illustrated machine 30, an indexing shaft 56 is provided to bring a succession of straws into frictional engagement with the belts 32, 33 and 34. It will be seen that the indexing shaft 56 is closely spaced from the belts 32—34 and is generally at right angles thereto, although the belts are angled slightly, as already noted.

As shown to best advantage in Figs. 7, 8 and 9, the indexing shaft 56 is formed with a plurality of longitudinal grooves 58 adapted to receive the straws to be convoluted. Each groove 58 is adapted to hold a portion of straw 20. The depth of each groove 58 is somewhat less than the diameter of the straw so that the straw will project outwardly beyond the indexing shaft 56 for engagement...
3 with the belts 32—34. Each groove 58 is smoothly polished and is formed with a rounded bottom 60 so that the straw may be readily rotated in the groove. Fig. 8 shows the manner in which the indexing shaft 56 presents the straws to the belts 32—34 so that the belts will spin the straws at high speed.

The convoluted straws 31 may be fed to the indexing shaft 56 from a hopper or magazine 62 (Fig. 3). The straws are picked from the hopper to the indexing shaft 56 through a narrow vertical passage or slot 64 formed between a plurality of front and rear guide plates 66 and 68. The slot 64 is made narrow so as to pass only one straw at a time. Thus the straws proceed in single file down the slot 64, as shown to best advantage in Fig. 7. The straws move by their own weight through the slot 64 to the indexing shaft 56.

In this case, the indexing shaft 56 has four longitudinal grooves 58. The passage or slot 64 is disposed directly over the shaft 56, while the belts 32—34 run horizontally below the shaft. Thus, while one of the grooves 58 presents a straw to the belts 32—34, the diametrically opposite groove is substantially aligned with the slot 64 so as to receive the straw therefrom. By means of a suitable intermittent drive 70 of the Geneva type, the indexing shaft 56 is advanced through successive steps of 90°. Two such steps are required to carry each straw from the bottom of the slot 64 to the belts 32—34.

The unconvoluted straws 31 are retained in the grooves 58 by means of a plurality of curved guides 74 which extend around the indexing shaft 56. In this case, the guides 74 are formed on the guide plates 66. It will be apparent from Figs. 3 and 7 that the guide plates 66 are positioned in the spaces between the belts 32—34.

After the straws have been convoluted, they pass away from the indexing shaft 56 through a slot or passage 76 formed between the guide plates 66 and 68. As shown to best advantage in Figs. 7 and 9, the exit passage 76 slopes upward to the belts 32—34 and away from the indexing shaft 56. The lower boundary of the slot 76 is formed by guide rails 78 which slant upwardly from the curved guides 74 on the plates 68. Each of the front guide plates 66 has a pointed stripper portion 80 which projects into an annular groove 82 in the indexing shaft 56 so as to strip the convoluted straws from the longitudinal grooves 58. The movement of the indexing shaft 56 pushes the straws upwardly through the exit passage 76.

To form the convolutions 28 in the straws, the machine is provided with a plurality of convoluting fingers or blades 86 which are movable into engagement with the outside of the rotating straw held against the moving belts 32—34 by the indexing shaft 56. In this case, the convoluting fingers 86 are positioned below the indexing shaft 56 and are movable upwardly against the straw held therein.

From Figs. 2 and 3 it will be apparent that the convoluting fingers 86 are disposed in the space between the second and third belts 33 and 34. At this point, the indexing shaft 56 has a reduced portion 88 which exposes a considerable portion of the straw so that the convoluting fingers 86 will be able to push the wall of the straw upwardly to a considerable extent. As shown in Fig. 5, each convoluting finger 86 has a reduced, relatively thin, curved edge portion 90 which actually engages the straw. The conformation of the edge portion 90 corresponds to the desired shape of the convolutions 28. Thus, the illustrated edge portion 90 is rounded to produce rounded convolutions.

In this case, the convoluting fingers or blades 86 are mounted for individual swinging movement on a shaft 92. The fingers 86 are adapted to be swung upwardly in succession from a plurality of angularly staggered cams 94 mounted on a cam shaft 96, each cam 94 having a narrow high portion or lobe 98 which raises the corresponding finger 86 momentarily against the straw. The high lobes 98 of the successive cams 94 are staggered angularly around the shaft 96 so that the convoluting fingers 86 act successively on the straw. As each convolution is formed, the straw is compressed axially by the converging belts 32—34. The compression of the straw makes the convolutions more pronounced than they would be from the action of the fingers alone.

In this case, the cam shaft 96 is adapted to be driven continuously by means of a pulley 100 which may be connected to a suitable motor or the like (not shown) by a belt 102. The cam shaft 96 is driven at a much slower speed than that of the drive shaft 44 for the belts 32—34. Thus, each straw is rotated through quite a large number of revolutions as it is being convoluted.

The intermittent Geneva drive 70 is connected between the cam shaft 96 and the indexing shaft 56 so that the indexing shaft will be advanced through one step for each revolution of the cam shaft. From Fig. 7 it will be apparent that the cams 94 are staggered through only a portion of the revolution of the cam shaft. The remaining portion of the revolution is employed to advance the indexing shaft 56.

The operation may be summarized by recalling that the unconvoluted straws 31 pass downward in a single file through the passage or slot 64. At the bottom of the passage 64, each straw, in turn, is received in one of the longitudinal grooves 58 formed in the indexing shaft 56. In two steps of the shaft 56, each straw is feit into engagement with the rapidly moving drive belts 32—34. The belts spin the straw at high speed in the groove 58. It will be noted that the inside of the straw is entirely unsupported and that the outside of the straw is supported only in the sense that it is retained in the longitudinal groove 58.

By the action of the staggered cams 94, the convoluting fingers 86 are successively swung upwardly against the rapidly spinning straw. The thin edge 90 of each convoluting finger 86 is pushed a substantial distance into the wall of the straw so that the wall is formed inwardly to produce the convolution. As the convolutions are formed, they are compressed axially by the action of the converging belts 32—34. The subsequent movement of the indexing shaft 56 pushes the convoluted straw through the exit passage 76. In this regard, it will be noted that the convoluted straws are stripped from the shaft 56 by the stripping points 80 on the guide plates 66, while the straws are carried upwardly away from the belts by the guide rails 78.

The illustrated convoluting machine will convolute the ordinary engagement with theraw paper straws at extremely high speed. The action of the centrifugal force on the rapidly spinning straw prevents the convoluting blades from collapsing the wall of the straw and thereby facilitates the convoluting operation. The convoluting action of the machine on waxed paper straws is facilitated if the straws fed to the machine are somewhat warm, so that the straws will be soft and pliable.

It will be apparent that the convoluting machine is effective and rapid in operation. Nevertheless, it is reasonably simple in construction, easy to manufacture and low in cost.

Various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention, exemplified in the foregoing description and defined in the following claims.

We claim:
1. In a machine for convoluting soda straws or the like, the combination comprising an indexing cylinder for holding the straws, said cylinder having a plurality of longitudinal grooves therein for receiving the straws, each of said grooves having a depth less than the diameter of the straws, so that the straws will project outwardly from the grooves, a plurality of endless belts disposed adjacent said cylinder for engaging and rotating one of the straws held therein, each of said endless belts being mounted on
a pair of pulleys, means for rotating said pulleys to drive said belts, said belts running generally at right angles to said indexing cylinder, means for intermittently rotating said indexing cylinder to bring each straw held therein into con volutions in said straw by said indexing means being connected to said cam shaft for advancing said indexing shaft through one step for each revolution of said cam shaft, said angularly related second and third belts being effective to exert endwise force on said straw so as to compress the convolutions formed by said fingers, and means for feeding said belts through said indexing shaft.

4. In a machine for convoluting tubular soda straws, the combination comprising first and second spaced generally parallel endless driving belts, means for supporting and advancing said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn against said belts for rotation thereof, a plurality of closely spaced convoluting elements movable against the straw engaged by said belts, means for moving said elements successively against said straw to form a series of closely spaced annular convolutions in said straw.

5. In a machine for convoluting tubular soda straws, the combination comprising first and second spaced generally parallel endless driving belts, drive means for supporting and advancing said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn against said belts for rotation thereby, a plurality of closely spaced convoluting elements movable against the straw engaged by said belts, means for moving said elements successively against said straw to form a series of closely spaced annular convolutions in said straw, means for supporting the space between said belts, at least one of said belts being angled with respect to the straw so as to compress the annular convolutions.

6. In a machine for convoluting tubular soda straws, the combination comprising first and second spaced generally parallel endless driving belts, drive means for supporting and advancing said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn against said belts for rotation thereby, a plurality of closely spaced convoluting elements movable against the straw engaged by said belts, means for moving said elements successively against said straw to form a series of closely spaced annular convolutions in said straw, said elements being disposed opposite the space between said belts, said belts being convergent at a small angle to compress the convolutions.

7. In a machine for convoluting soda straws or the like, the combination comprising an indexing shaft having a plurality of longitudinal grooves therein for receiving a succession of straws, first and second endless belts disposed adjacent said shaft for engaging and rotating one of the straws held therein, drive means for supporting and advancing said belts, said belts running generally at right angles to said indexing shaft, means for intermittently rotating said indexing shaft to bring each straw held thereinto into con volutions in position for engaging said belts, means for feeding said straws to said indexing shaft at a point spaced from said convoluting position, a plurality of closely spaced convoluting fingers movable into engagement with longitudinally spaced points in the straw held in said shaft at the convoluting position, a plurality of angularly staggered cams on said cam shaft for swinging said fingers successively against the straw to form a series of annular convolutions therein, means for rotating said cam shaft, said indexing means being connected to said cam shaft for advancing said indexing shaft through one step for each revolution of said cam shaft, said angularly related second and third belts being effective to exert endwise force on said straw so as to compress the convolutions formed by said fingers, and means for carrying away the convoluted straw from said indexing shaft.

8. In a machine for convoluting tubular soda straws, the combination comprising first and second generally parallel endless driving belts, said belts being spaced apart edge to edge, respective pairs of pulleys supporting said
driving belts, means for rotating said pulleys to advance said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn to a convoluting position with said straw against said belts for rotation thereby, and means engageable with the outside of the straw at the convoluting position for forming convolutions around said straw.

9. In a machine for convoluting tubular soda straws, the combination comprising first and second spaced generally parallel endless driving belts, means for supporting and advancing said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn to a convoluting position against said belts for rotation thereby, and means engageable with the outside of the straw at the convoluting position along the portion of said straw between said belts for forming convolutions around said straw.

10. In a machine for convoluting tubular soda straws, the combination comprising first and second spaced generally parallel endless driving belts, means for supporting and advancing said belts, indexing means for receiving a succession of soda straws and advancing each straw in turn to a convoluting position against said belts for rotation thereby, and means engageable with the outside of the straw at the convoluting position along the portion of said straw between said belts for forming convolutions around said straw, said belts being convergent at a small angle to compress the convolutions as they are formed.

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